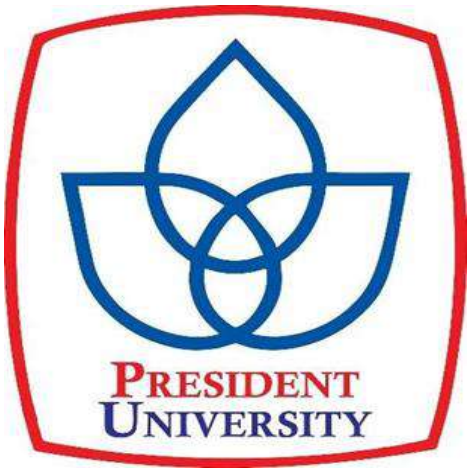

COMPARISON OF MAXIMUM LIKELIHOOD ESTIMATION AND METHOD OF MOMENTS FOR ESTIMATING PARETO DISTRIBUTION PARAMETERS ON MEDICAL MALPRACTICE CLAIMS

UNDERGRADUATE THESIS

Submitted as one of the requirements to obtain

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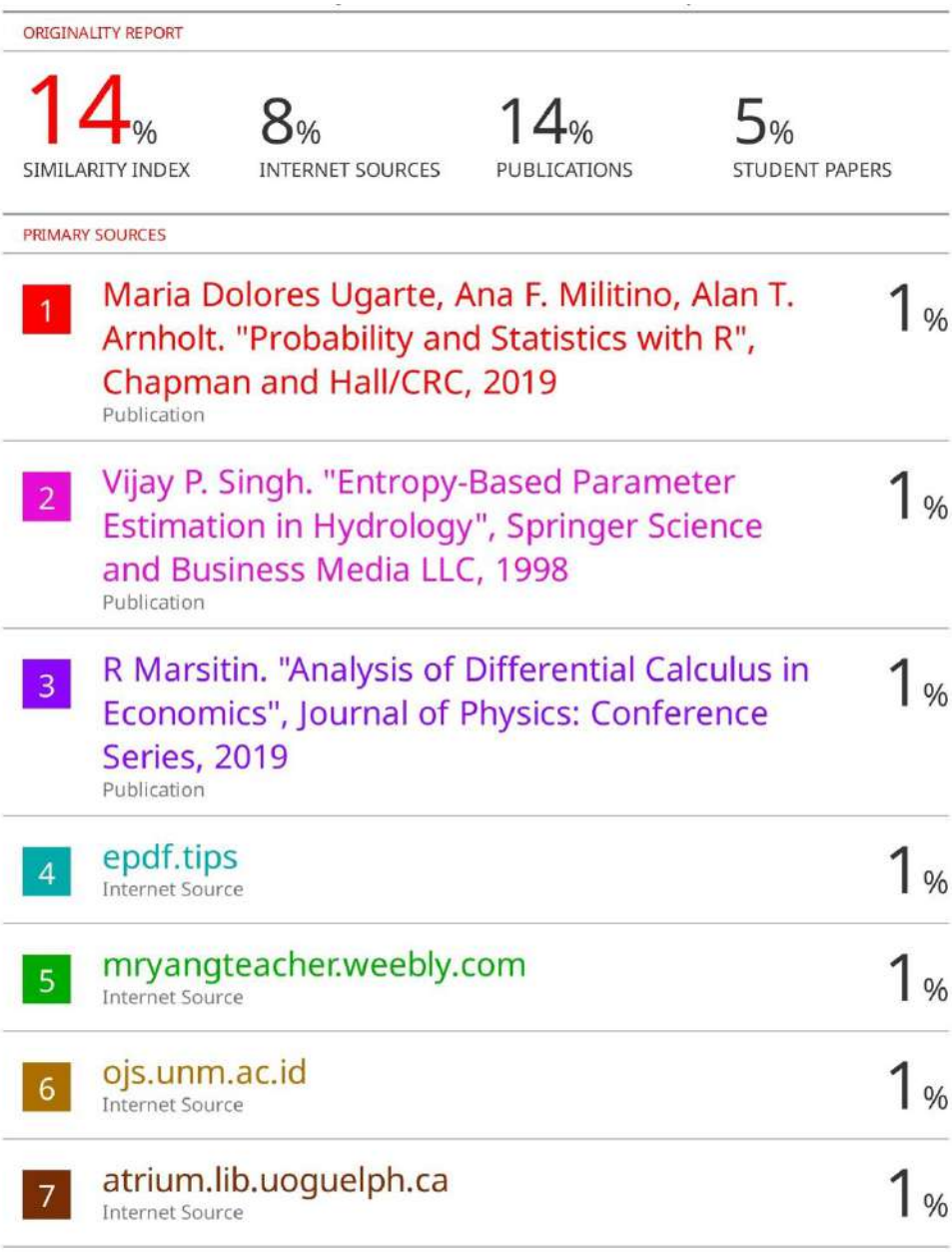

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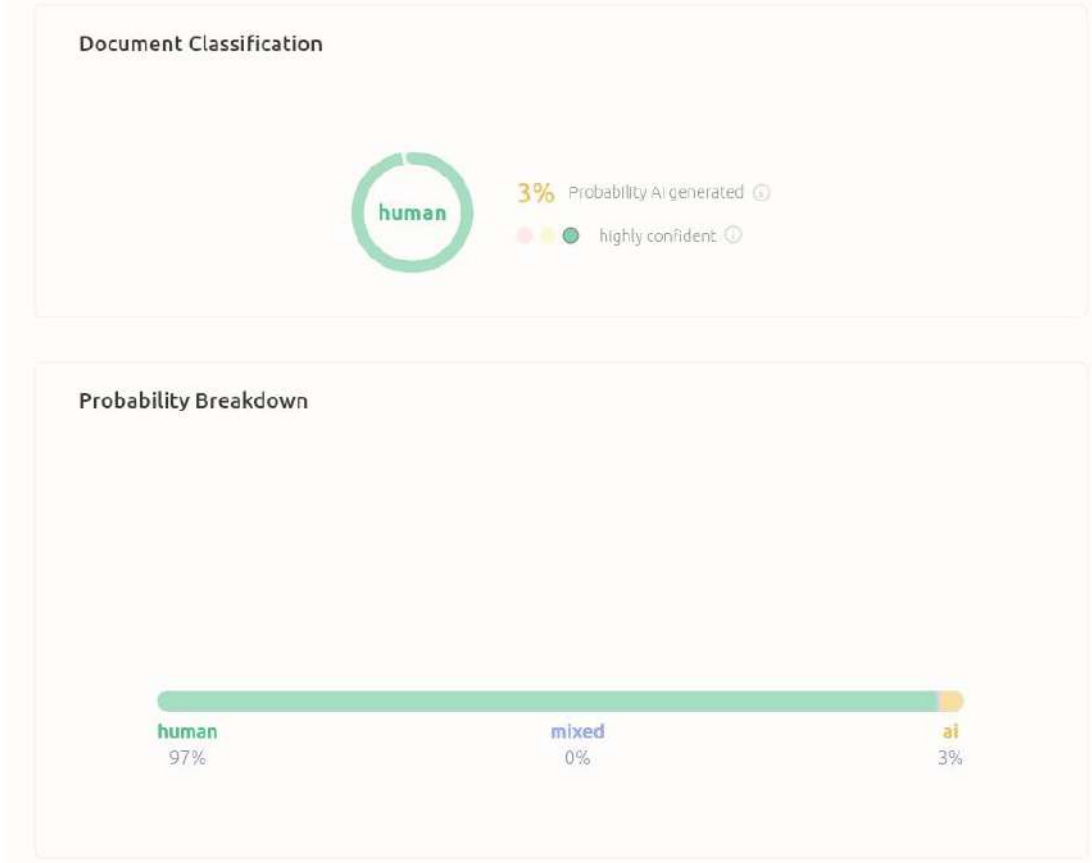

ABSTRACT

Medical Malpractice Claims present unique challenges for healthcare providers and insurance carriers because of their uncertain nature. Large financial losses arising from a high claim count are difficult to quantify. Therefore, an appropriate distribution model and estimation method are essential for effective risk management and planning. One of the significant distribution models is Pareto Distribution, having estimation techniques such as Maximum Likelihood Estimation (MLE) and Method of Moments (MoM). The objective of this study is to investigate the potential performance disparity between two major types of methods that is Maximum Likelihood Estimation and Method of Moments for estimating Pareto distribution parameters on medical malpractice claims data as applied specifically to the frequency-of-claims problem, focusing particularly on claim ages falling within age interval 36–65 years. The evaluation is done based on error metrics that is Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE). The analysis results show that MAE value for MoM is 0.02065, while for MLE is 0.01883. The MAPE calculation results show that the prediction value of MoM is 63%, while that of the MLE is 57%. In addition, the MSE value for MoM is 0.00060 and for the MLE is 0.00047. Last, the RMSE value for MoM is 0.02440, while for the MLE is 0.02163. Furthermore, the MAPE exceeding 50% indicates both methods are less effective for this particular case. However, based on the MAE, MSE, and RMSE results in this study, MLE and MoM show almost the same accuracy, so both methods can be considered equally good for parameter estimation. Nonetheless, in general, MLE is often considered a better method than MoM due to its more comprehensive approach in theory.

Keywords: *Medical Malpractice Claims, Pareto Distribution, Maximum Likelihood Estimation, Method of Moments*

ABSTRAK

Klaim malpraktik medis merupakan tantangan besar bagi tenaga medis dan perusahaan asuransi karena ketidakpastiannya yang tinggi. Banyaknya klaim dapat menimbulkan kerugian finansial yang signifikan dan sulit diprediksi. Untuk perencanaan risiko yang lebih efektif, diperlukan model distribusi dan metode estimasi yang tepat. Salah satu model distribusi yang relevan adalah Distribusi Pareto, dengan metode estimasi seperti Maximum Likelihood Estimation (MLE) dan Method of Moments (MoM). Penelitian ini bertujuan untuk membandingkan dua metode utama yaitu Maximum Likelihood Estimation dan Method of Moments, dalam menentukan parameter distribusi Pareto pada data klaim malpractice medis khususnya pada frekuensi klaim untuk rentang usia 36-65 tahun. Evaluasi dilakukan menggunakan metrik kesalahan yaitu Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), Mean Squared Error (MSE), dan Root Mean Squared Error (RMSE). Hasil analisis menunjukkan bahwa MAE untuk MoM adalah 0.02065, sedangkan untuk MLE adalah 0.01883. MAPE menunjukkan 63% untuk MoM dan 57% untuk MLE. MSE untuk MoM adalah 0.00060, sementara untuk MLE adalah 0.00047. RMSE untuk MoM adalah 0.02440, sedangkan untuk MLE adalah 0.02163. Selain itu, MAPE yang melebihi 50% menunjukkan bahwa kedua metode kurang efektif untuk kasus ini. Namun, berdasarkan hasil MAE, MSE, dan RMSE dalam penelitian ini, MLE dan MoM menunjukkan akurasi yang hampir sama, sehingga kedua metode dapat dianggap sama-sama baik untuk estimasi parameter. Meskipun demikian, secara umum, MLE sering dianggap sebagai metode yang lebih baik dibandingkan MoM karena pendekatannya yang lebih komprehensif secara teori.

Keywords: *Klaim Malpraktik Medis, Distribusi Pareto, Maximum Likelihood Estimation, Method of Moments*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES